

[54] ELECTROSTATOGRAPHIC COMPENSATION APPARATUS

[75] Inventor: Conrad Altmann, Rochester, N.Y.

[73] Assignee: Eastman Kodak Company, Rochester, N.Y.

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355/71, 95/64 D

[51] Int. Cl.G03g 15/00

[58] Field of Search.....355/3, 14, 16, 71,
355/67; 95/64 D

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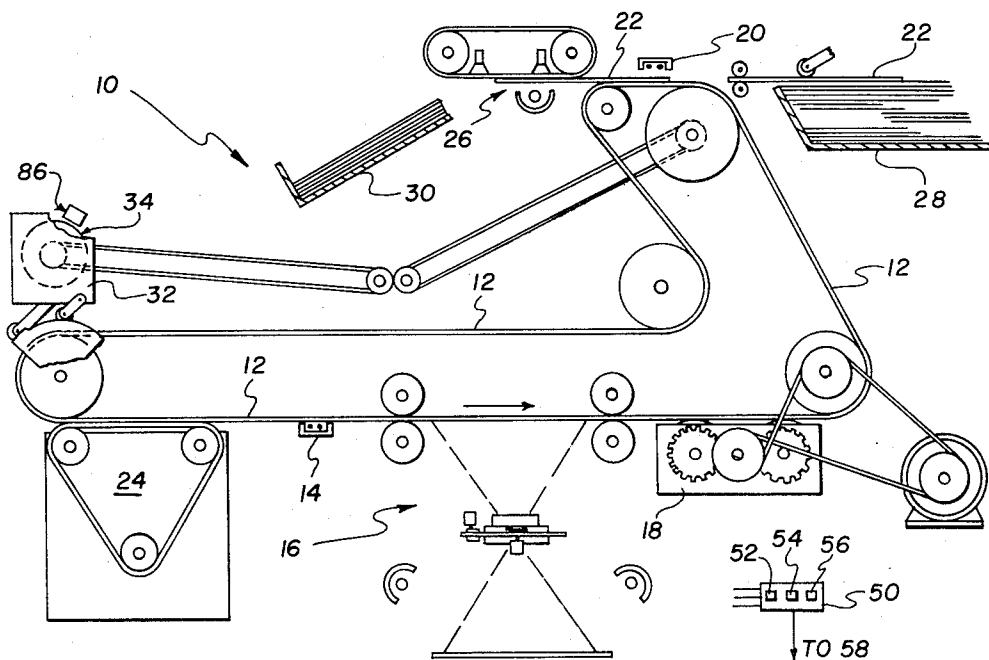
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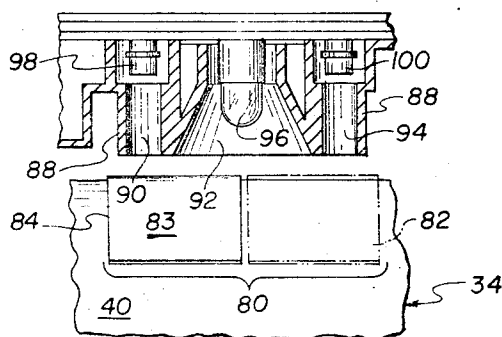
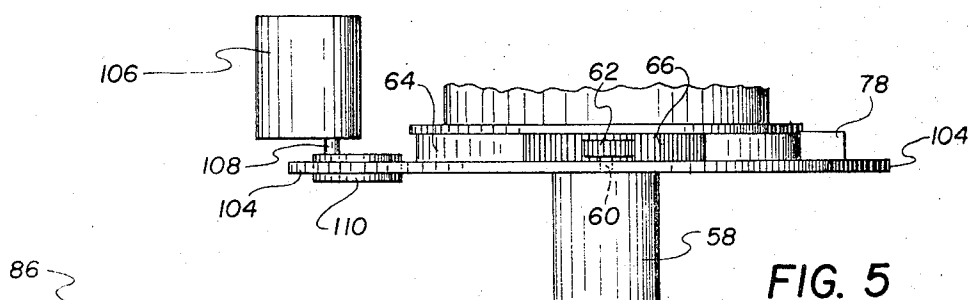
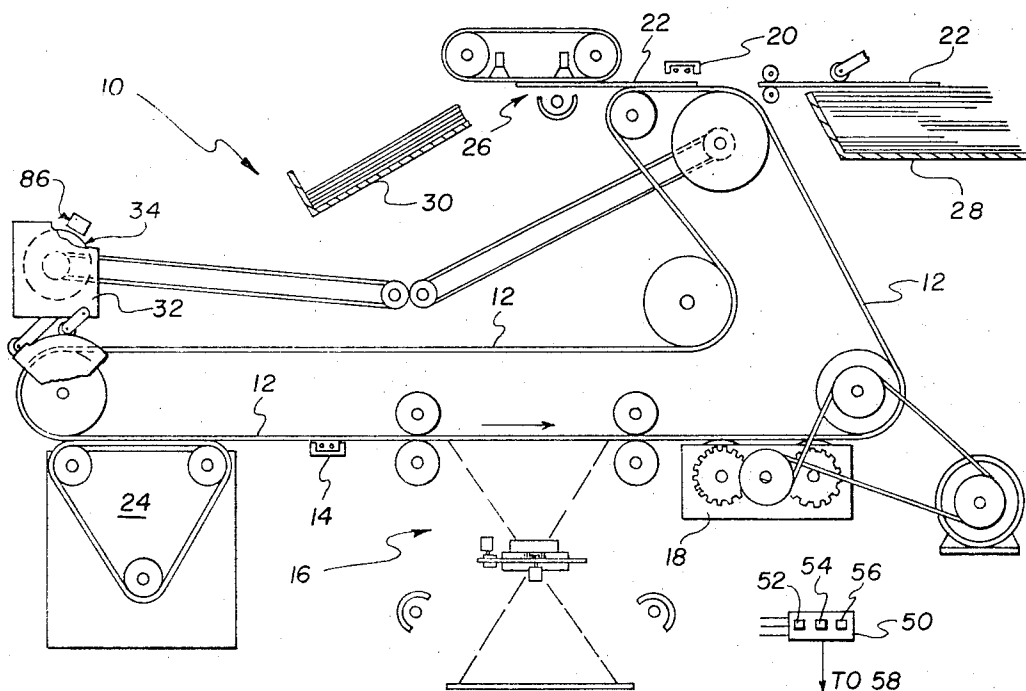
Primary Examiner—Robert P. Greiner
Attorney—W. H. J. Kline et al.

[57] ABSTRACT

In an electrostatographic copying device of the type which utilizes a replaceable web having a particular sensitivity response which falls into one of a number of sensitivity response ranges, the particular sensitivity response range of each web being encoded thereon or on a cartridge in which the web is disposed, compensation apparatus adapted to alter any one of a number of operations performed with respect to a utilized web, in a manner which insures comparable copies when webs of differing sensitivity are employed from time to time.

9 Claims, 7 Drawing Figures





CONRAD ALTMANN
INVENTOR.

BY *Saul A. Seimberg*
W. H. J. Kline
ATTORNEYS

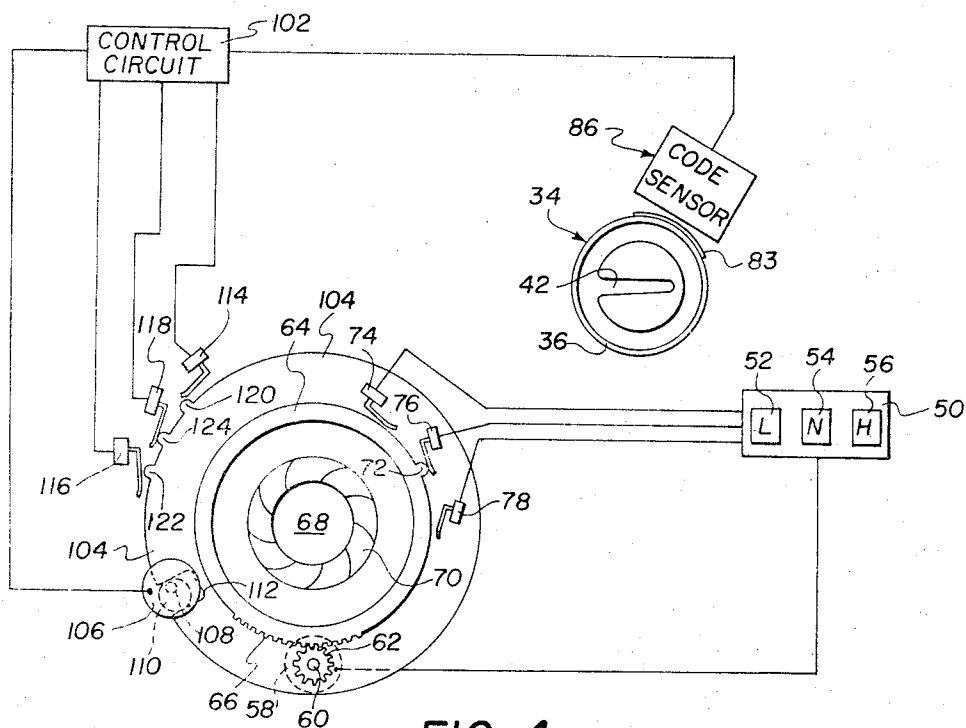


FIG. 4

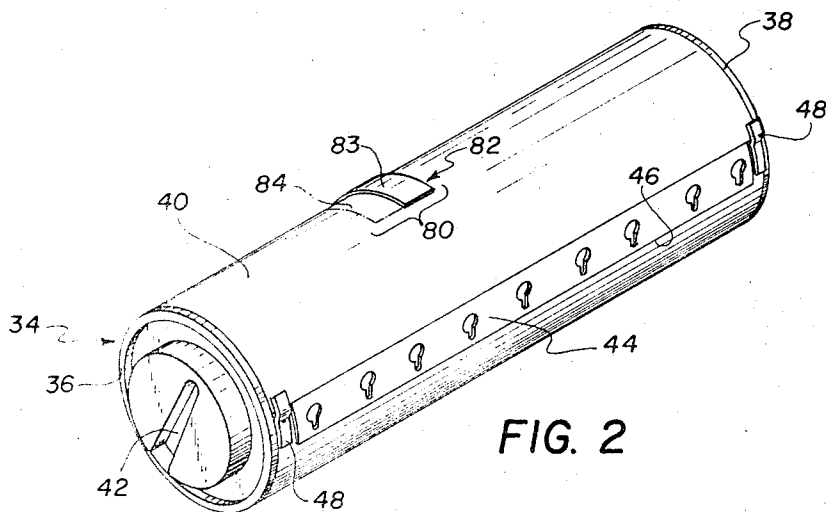


FIG. 2

CONRAD ALTMANN
INVENTOR.

BY *Paul A. Steinberg*
H. N. J. Kline
ATTORNEYS

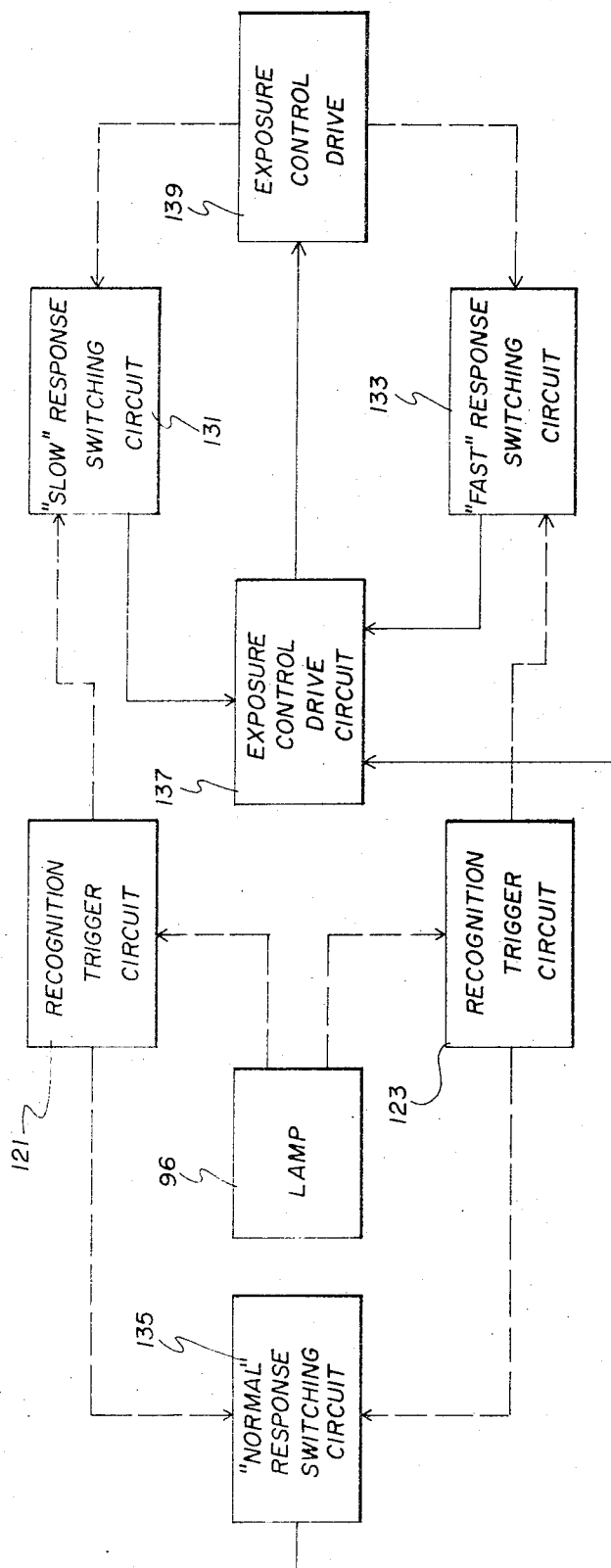


FIG. 6

CONRAD ALTMANN
INVENTOR.

BY *Paul A. Seiberg*
W. H. J. Heine
ATTORNEYS

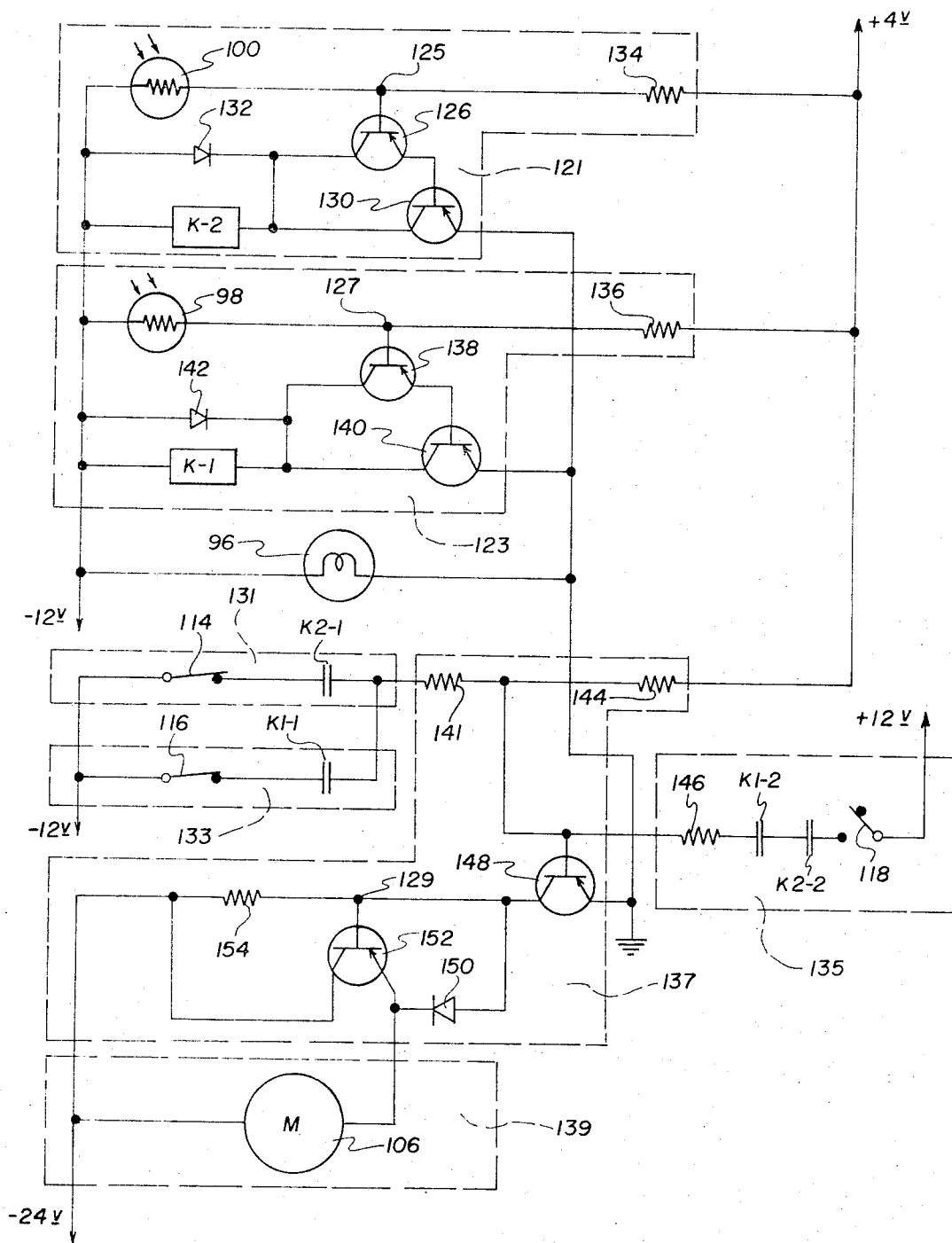


FIG. 7

CONRAD ALTMANN
INVENTOR.

BY *Paul A. Seiberg*
H. N. J. Kline
ATTORNEYS

ELECTROSTATOGRAPHIC COMPENSATION APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

Reference is hereby made to commonly assigned and copending U.S. Pat. application Ser. No. 213,014, entitled Control Circuitry For Assisting Electrostatographic Compensation, filed on Dec. 28, 1971, in the names of Franklin L. Guyette and Donald R. Frank, now U.S. Pat. No. 3,700,323.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electrostatographic copying devices and, more particularly, to apparatus for automatically effecting compensation in such devices as a function of the sensitivity response of a web utilized therein.

2. Description of the Prior Art

Electrostatographic copying devices are known in the art. In one particular type of such devices, a photosensitive web is utilized, the operative segments of which are sequentially exposed to an original document which is to be copied. The exposure step charges the operative web segments, converting the light image to a latent electrostatic charge pattern which is subsequently converted to a visible developed image.

It has been found that, because of manufacturing tolerances, the photoconductive webs will vary significantly in photosensitivity response as well as in other properties which affect the quality of the resultant copies. Consequently, each time a web is changed, copy quality and comparability will change without compensation therefor. There is, therefore, a need for compensation apparatus to overcome the problem of variation in web response.

In the particular type of electrostatographic copying device described, there is sometimes included automatic or manually operated exposure control means which are employed to compensate for differences in the contrast quality of the original documents to be copied. Such apparatus is used to obtain comparable copies regardless of differences in contrast from document to document. In view of this, any compensation introduced to negate copy differences due to web-to-web sensitivity variations, cannot interfere with or reduce the effect of the document contrast compensation.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of the present invention to provide, in an electrostatographic copying device which utilizes a sensitized web, automatic compensation for variations in web sensitivity when a web is changed.

It is a further object of the present invention to provide such web sensitivity compensation in a manner which will not interfere with document contrast compensation.

It is an additional object of the present invention to provide such web sensitivity compensation automatically in response to coded sensitivity information carried by the web itself or on a cartridge in which it might be enclosed.

Accordingly, there is provided for use in an electrostatographic copying device, compensation apparatus for minimizing or negating the problem raised by variations in web-to-web sensitivity. One example of such compensation apparatus is embodied in exposure compensation apparatus which includes a rotatable plate connected to the diaphragm of an exposure station in the device, drive means for rotating the plate to open or close the diaphragm, sensing means for decoding and translating the sensitivity range of the utilized web into signals indicative thereof, switching means cooperably associated with the plate for generating signals indicative of its movement to a correct exposure position and a control circuit connected to the drive means, the sensing means and the switching means for energizing the drive means to effect movement of the plate to the correct exposure position in accordance with the indicated sensitivity range of the web and for de-energizing the drive means in response to a signal from the switching means indicating that the correct exposure position has been reached by the plate.

Other objects and advantages of the present invention will become apparent from the detailed description of the preferred embodiment set forth in detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the preferred embodiment of the invention presented below, reference is made to the accompanying drawings in which:

FIG. 1 schematically illustrates an electrostatographic copying device wherein the present invention is utilized;

FIG. 2 illustrates a cartridge, in which a sensitized web is disposed, for use in the electrostatographic device of FIG. 1;

FIG. 3 depicts a code sensor, partly broken away for clarity, which is employed to aid in determining the sensitivity range of a web to be used as indicated by a coding arrangement thereon;

FIG. 4 schematically illustrates exposure compensation means according to the present invention aided by the code sensor of FIG. 3 and a control circuit;

FIG. 5 is a side view of the exposure compensation means shown generally in FIG. 1 and more specifically in FIG. 4;

FIG. 6 is a block diagram of the control circuit shown in FIG. 4; and

FIG. 7 is a schematic diagram of the constituent elements of the block diagram of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference numerals have been used in the several views to describe like elements, FIG. 1 illustrates an electrostatographic copying device 10 of the type wherein the present invention can be advantageously used. This device includes a photosensitive web 12 disposed about a plurality of rollers 13 and is adapted to be driven thereby along an endless path through a series of electrophotographic or electrostatographic work stations.

Electrophotosensitive web 12 is commonly constructed including a photoconductive layer with a conductive backing carried by a flexible support such as,

for example, a film base. Examples of such webs and methods for their preparation will be found in commonly assigned U.S. Pat. No. 3,141,770 issued in the name of Davis et al. For simplicity, the multilayered construction of web 12 has not been specifically shown in the drawings of this application.

The electrophotographic or electrostatographic stations of the device 10 illustrated in FIG. 1, include a charging station 14 whereat a uniform charge is applied to the surface of the photoconductive layer of web 12, an exposing station 16 whereat the uniformly charged photoconductive layer of web 12 is exposed to imagewise projected actinic radiation creating an electrostatic image thereon, a developing station 18 whereat finely divided toner particles are applied to the photoconductive layer of web 12 creating a toner image thereon, a transfer station 20 whereat the toner image is transferred to a surface of receiving sheet 22 and a cleaning station 24 whereat residual toner is removed from the surface of web 12 and any remaining electrostatic charge is dissipated. After passing cleaning station 24, the cleaned operative segment of electrophotosensitive web 12 is ready for recycling and reuse.

Transfer sheet 22 carrying the transferred toner image is subsequently fed to a fixing station 26 where the toner image is fused yielding a final reproduction. Successive transfer sheets 22 are fed from a supply station 28 to the transfer station 20 and are discharged therefrom after the fusing operation to a storage station 30.

It will be understood that the particular apparatus illustrated in FIG. 1 is merely exemplary and that the invention disclosed and claimed herein is usable with similar apparatus in which some of the above-described electrophotographic or electrostatographic work stations are eliminated, combined with others or substantially changed or supplemented in function. It will also be understood that the invention disclosed and claimed herein is usable in non-electrophotographic apparatus.

By utilizing the device 10 shown in FIG. 1, a large number of copies can be made by repetitive use of the operative segments of a single electrophotosensitive web. However, after continued use, the photoconductive layer of web 12 tends to lose some of its image transference properties. This occurs for a number of reasons, primary of which is the buildup of a small layer of scum as a result of the repetative developing and cleaning processes. In order to overcome this degradation of performance of the photoconductive layer of web 12, a web inserting, removing and/or replacement station 32 has been provided. The details of operation of the web replacement station 32 are set forth specifically in commonly assigned U.S. Pat. application Ser. No. 834,695, filed in the name of Thaddeus Swanke, filed on June 19, 1969, now U.S. Pat. No. 3,619,050. For purposes of this description it is sufficient to appreciate that web replacement is made possible by and takes place at the web replacement station 32.

As is shown in FIG. 2, the photosensitive web 12 is provided and disposed within a light-tight cartridge 34. The cartridge 34 is utilized to store fresh photosensitive webs, such as web 12, and to receive used webs of the same type for disposal. Cartridge 34 includes a pair of circular end caps 36 and 38, the edges of which are at

least partially overlapped by a coil of protective sheet material 40. End cap 36 has a "V-shaped" retaining depression formed in its surface which is adapted to cooperate with a male dart (not shown) disposed within the web replacement station 32. The cooperation between the male dart and depression 42 helps effect proper support and orientation of cartridge 34 upon its insertion into the web replacement station 32.

The photosensitive web 12 is wound about a core (not shown) with its leading edge 44 extending out from opening 46. The details of securement of the protective sheet 40 are set forth in commonly assigned U.S. Pat. application Ser. No. 835,128, filed in the name of Clifford B. Bushnell, filed on June 20, 1969, now U.S. Pat. No. 3,645,385.

When actuated by an operator, the mechanism of the web replacement station 32, as is described in greater detail in the above-referenced U.S. Pat. application Ser. No. 834,695, opens the cartridge 34 and positions the leading end 44 of web 12 to be contacted by a towbar (not shown). The towbar is adapted to engage leading end 44 and to thread it along the endless path in the electrostatographic device 10, past the various work stations as described above. The endless path to be traversed by web 12 in the apparatus 10 is herein termed the "operative path." Upon completion of towbar travel around the operative path, means (not shown) are provided to couple the trailing end (not shown) of web 12 to the towbar and to splice the leading and trailing ends together, thereby providing an endless web. Also provided are means (not shown) which, upon actuation, disengages the web ends and feeds a used web from the operative path back into cartridge 34.

Also provided in the device 10, and schematically illustrated in FIGS. 1 and 4, is a document exposure control 50. The document exposure control 50 is provided to enable an operator to compensate for vibrations in the contrast quality of a document to be copied. If, for example, a document having high contrast quality, a relatively high density range, is to be copied, the document exposure control 50 is operated to cause a reduction in exposure in the exposing station 16. If, on the other hand, a document of low quality contrast, a relatively low density range, is to be copied, the document exposure control 50 is operated to cause an increase in exposure in the exposure station 16. It will be noted that the document exposure control 50 includes three manually operated pushbuttons 52, 54 and 56, to control exposure respectively for high, normal and low contrast quality of documents to be copied. It will be appreciated that the number of pushbuttons can be increased or decreased depending upon the degree of exposure control required.

In general, the document exposure control 50 operates in the following manner. Selection of a particular pushbutton causes current to be fed to motor 58. Energization of motor 58 causes its shaft 60 to rotate. Fixedly mounted to shaft 60, as shown in FIG. 4, is a spur gear 62 which rotates with shaft 60. Diaphragm ring 64, which when rotated changes the diaphragm opening 68, includes a gear segment 66 mounted in meshing engagement with spur gear 62. Thus, when motor 58 is energized, the diaphragm ring 64 is rotated thereby opening or closing the diaphragm

70 which increases or decreases diaphragm opening 68 varying the exposure in accordance with the contrast quality of the document to be copied.

More specifically, the document exposure control 50 operates in the following manner. Corresponding to each of the document contrast quality pushbuttons 52, 54, and 56, is a diaphragm position or limit switch 74, 76 and 78 respectively. As shown in FIG. 4, diaphragm ring 64 is positioned with its switch cam 72 engaging limit switch 76, the switch, in this example, which corresponds to a normal document contrast quality range. If, at this point, it was desired to copy a document of low quality contrast, then the corresponding pushbutton 52 for such a document would be actuated. This would result in motor 58 being energized by a control circuit (not shown) which is responsive to signals from the pushbuttons 52, 54 and 56. The control circuit can be similar to control circuit 102, the details of which are hereinafter explained, or it can be of any suitable type.

Upon receipt of a signal from pushbuttons 52, 54 or 56, the control circuit causes motor 58 to be energized, which, in turn, causes the diaphragm ring 64 to be rotated until limit switch 78 is actuated by the cam 72. Actuation of limit switch 78 is sensed by the control circuit which shuts off current flow to motor 58. The movement of diaphragm ring 64 from its "normal" to its "low" contrast positions, results in the diaphragm 70 being opened by a sufficient amount to compensate for the difference in document contrast quality. As a result, this increase in exposure allows comparable copies to be made regardless of the difference in original document contrast quality.

In a similar manner, assuming a copy was desired from a document of high contrast quality, the corresponding pushbutton 56 would be selected. The control circuit, in response, would cause the diaphragm ring 64 to be driven to where cam 72 would actuate limit switch 74. The resultant counterclockwise rotation of diaphragm ring 64 would close diaphragm 70 by a sufficient amount to compensate for the difference in document contrast quality. As a result, this decrease in exposure allows comparable copies to be made regardless of the difference in original document contrast quality.

It will be appreciated by those having skill in this art, that in this instance satisfactory exposure compensation is obtained by varying only the size of the diaphragm opening. However, such exposure compensation can be achieved by varying the time of exposure to even the intensity of the illumination in exposure station 16, or some combination of these exposure factors. That is, the signals received from the document exposure control station 50 could be utilized to control the speed of a shutter moving across the optical path or the filament voltage of the illuminating source or both. Alternatively, such signals can be employed to vary, by way of example, the charge applied to the photosensitive web 12 at the charging station 14 or to vary development at developing station 20 to compensate, as required, for differences in original document contrast quality from document to document. It should be further appreciated that such compensation can be manually initiated, as in the preferred embodiment, or can be automatically initiated by means of appropriate

circuitry cooperably connected to sensing devices, such as photocells.

Because of manufacturing tolerances, the web 12 will not always exhibit the same photosensitivity. In addition, other web 12 properties, such as its static charge behavior, are affected in and varied by the particular manufacturing processes employed. If such variations are not compensated for, it will be difficult, if not impossible, to achieve comparable copies of a given document where different webs are used. In recognition of this problem, the disclosed apparatus provides a mechanism for achieving photosensitivity and other compensation which is operable without effect upon document contrast quality compensation.

As noted above, variations in web sensitivity can cause variations in copy quality, where such copies are prepared in an electrostatographic copying device which utilizes such photosensitive webs. In recognition of this problem, photosensitive webs intended for such use are tested and sorted into three sensitivity ranges; slow, normal and fast, respectively, which cover the manufacturing range. It will be appreciated that, depending upon the degree of copy comparability desired from web to web, the number of sensitivity ranges can be increased or decreased as required. For purposes of this description, the number of sensitivity ranges has been arbitrarily fixed at three. It will be further appreciated that the webs can be divided, as well, into ranges which indicate their charge transference response. Thus, for example, a web which has "fast" photosensitivity response may exhibit a "slow" acceptance of static charge response. Such a web may then be placed into a "normal" range, which would be indicative of the totality of its response in the device 10.

In the preferred embodiment, the cartridges 34 in which the photosensitive webs 12 are packaged for use carry a precoded indication of the particular sensitivity range of the included web. As shown in FIG. 2, cartridge 34 carries on its surface a coding location 80 which consists of coding positions 82 and 84. The particular sensitivity range for a web 12 included therein is indicated by placing a strip of tape in either or both of coding positions 82 and 84. Alternatively, a black mark can be printed or painted in either or both of coding positions 82 or 84. In the arrangement of the preferred embodiment, a non-reflective strip of tape 83 is employed to cover the reflective surface of a cartridge 34 at its coding positions 82 and 84. It will be realized that the roles of the tape and cartridge surface can be readily reversed, that is, the tape surface can be made reflective and the cartridge surface made non-reflective. It is also important to note that the coding location 80 can be formed on or carried by the web 12 itself, rather than by the cartridge 34.

Since coding location 80 can accommodate two non-reflective strips of tape 83, the absence or presence of one or both of these strips is indicative of the possible sensitivity range of the web. In the preferred embodiment, as shown in FIG. 2, a strip of tape 83, affixed to coding position 84, is utilized to indicate the "slow" range of web sensitivity. Affixing the strip of tape 83 instead to coding position 82, indicates a web having photosensitivity falling into the "fast" range. Finally, a cartridge 34 carrying a web having "normal" sensitivity

ty, does not carry a strip of tape 83 at either of the coding positions 82 and 84. Those having skill in this art will appreciate that other variants of the preferred coding scheme can be used to identify the web sensitivity ranges to be encountered and that other coding indicia, such as, for example, notches on the cartridges, can be utilized in place of the tape strips 83. Furthermore, it should be appreciated that the particular coding scheme which is utilized can be encoded so that the totality of web response, above and beyond its photosensitivity response, is accounted for.

When a cartridge 34 is properly inserted and oriented in the web replacement station 32, its coding location 80 faces a code sensor 86, which is most clearly illustrated in FIG. 3. Code sensor 86 includes a housing 88 having three openings 90, 92 and 94 formed therein. Mounted within the outwardly tapered housing opening 92 is lamp 96 which serves to illuminate the coding location 80. Mounted respectively within openings 90 and 94, are photosensors 98 and 100. Openings 90 and 94 are aligned with the respective corresponding coding positions 84 and 82. Consequently, illumination from lamp 96 will be reflected therefrom to impinge upon photosensors 98 and 100 in the absence of a tape strip 83.

The presence of a tape strip 83 in coding position 82, signifying a "slow" sensitivity web, prevents illumination from impinging upon photosensor 100. Similarly, the presence of a tape strip 83 in coding position 84, signifying a "fast" sensitivity web, prevents illumination from impinging upon photosensor 98. As will hereinafter be described in greater detail, the "darkening" of either photosensor 98 or 100 causes control circuit 102 to drive the diaphragm ring 64 to a position appropriate for the sensitivity range of the web to be used.

As shown in FIGS. 4 and 5, motor 58 and switches 74, 76 and 78, are mounted on a switch plate 104. Mounted adjacent switch plate 104 is motor 106 having a shaft 108 to which cam 110 is eccentrically mounted. Motor 106 is positioned so that cam 110 fits within a slot 112 in switch plate 104, slot 112 being only slightly larger than the diameter of cam 110.

Energization of motor 106 causes cam 110 to be rotated which, in turn, drives switch plate 104. Mounted adjacent switch plate 104 are limit switches 114, 116 and 118, which correspond respectively to the "slow," "fast" and "normal" sensitivity ranges of the photosensitive webs. Switch cams 120, 122 and 124 formed on switch plate 104 actuate switches 114, 116 and 118, respectively, as switch plate 104 is rotated by the driving action of the eccentrically mounted cam 112. The switches 114, 116 and 118 and the switch cams 120, 122 and 124 are respectively arranged or spaced so that only one of the switches can be actuated at a particular time by its associated switch cam.

When switch plate 104 is thusly rotated, motor 58 and switches 74, 76 and 78 which are mounted thereon, are also moved. Because of the internal gearing of motor 58, its shaft 60 is rather difficult to turn when motor 58 is de-energized. As a result, the movement of switch plate 104 in a clockwise direction causes spur gear 62 to move the gear segment 66 in a clockwise direction. This movement rotates the diaphragm ring 64 and increases the size of diaphragm

opening 68 to compensate for a "slow" sensitivity web. Since the switches 74, 76 and 78 and switch cam 72 are all rotated through the same angle, along with diaphragm ring 64, the range of document contrast quality compensation is merely shifted and not disturbed. Similarly, counterclockwise movement of switch plate 104 causes the diaphragm ring 64 to be rotated in the same direction thereby decreasing the size of diaphragm opening 68. Such movement compensates for a "fast" sensitivity web without disturbing the range of document contrast quality compensation. By way of review, it should be noted that energization of motor 58 will have no effect on the position of switch plate 104 although it will cause, as previously noted, an independent change in the size of diaphragm opening 68 in accordance with the contrast quality of the document to be copied.

Control circuit 102 operates, in response to the sensing of an encoded web response, in the following manner. A block diagram of control circuit 102 is illustrated in FIG. 6. A recognition trigger circuit, 121 and 123, is provided for each of the sensitivity ranges, other than the "normal" response range, to be encountered. Thus, in general, if there are n sensitivity ranges, there will be " n minus one" recognition trigger circuits. It will be appreciated that depending upon the particular coding scheme selected, the sensitivity range for which a recognition trigger circuit is not provided, need not be a median or a "normal" sensitivity range.

In the described embodiment, recognition trigger circuit 121 is actuated by radiation from lamp 96 in response to the presence of a web 12 having "slow" sensitivity response. Similarly, recognition trigger circuit 123 is actuated by radiation from lamp 96 in response to the detection of a web 12 having a "fast" sensitivity response. When actuated, as shall hereinafter be described in greater detail, recognition trigger circuits 121 or 123 cause respectively, the "slow" response switching circuit 131 or the "fast" response switching circuit 133 to actuate the exposure control drive circuit 137. When so actuated, the exposure control drive circuit 137, in turn, causes energization of an exposure control drive 139 which adjusts one of the exposure factors in accordance with the decoded response of the included web 12.

At the same time, when proper exposure in accordance with the sensitivity response of the included web 12 is obtained, the response switching circuit, 131 or 133 in the described embodiment, which has caused energization of the exposure control drive 139 is disabled. This shuts down the exposure control drive circuit 137 and holds exposure compensation at the required level.

When a "normal" sensitivity range web 12 is utilized, both recognition trigger circuits 121 and 123 are actuated. In addition to the above-mentioned responses of the response switching circuits 131 and 133, the exposure control drive circuit 137 and the exposure control drive 139, the "normal" response switching circuit 135, which acts as a logical AND circuit, is also actuated. When the proper exposure compensation for a "normal" web is obtained, if any is required, the "normal" response switching circuit turns off the exposure control drive circuit 137 thereby halting further exposure compensation by the exposure control drive 139.

Control circuit 102, which is utilized to control operation of motor 106 in response to the detected sensitivity range of a web 12, is schematically illustrated in FIG. 7. Control circuit 102 operates in the following detailed manner. Power is supplied continuously from the indicated sources when the main power switch (not shown) of the device 10 is turned on. This causes current flow through lamp 96 and readies the code sensor 86. With lamp 96 illuminated, but no cartridge 34 inserted in the web replacement station 32, photosensors 98 and 100 are in the "dark" and exhibit very high resistive values. Consequently, the junction 125 of the voltage dividers formed by photosensor 100 and resistor 134 and the junction 127 of the voltage are held relatively positive. With junctions 125 and 127 so biased, the base-emitter junctions of transistors 126, 130, 138 and 140 are reversed biased maintaining these transistors in a "cut-off" or non-conducting condition. In addition, with photosensors 98 and 100 in the "dark," transistors 148 and 152 are also maintained in a "cut-off" condition.

It is assumed, at this point, for explanatory purposes that a cartridge 34 carrying a web 12 which falls into the "slow" sensitivity range and is so coded, has been inserted into the web replacement station 32. As previously noted, a "slow" range web 12 carries a tape strip 83 at coding position 84. This prevents illumination from reaching photosensor 98, while allowing illumination to impinge upon photosensor 100. Thus, junction 127 is held at its original bias condition while junction 125, due to the decrease in resistive value exhibited by photosensor 100 when illuminated and the higher relative value of resistor 134 with respect thereto, approaches the -12V supply in value. This forward biases the emitter-base junctions of transistors 126 and 130, which are thereby turned on, allowing current to flow through relay coil K2, which closes relay contacts K2-1 and K2-2. It is also important to note that the coding location 80 can be formed on or carried by the web 12 itself, rather than by the cartridge 34.

When relay contacts K2-1 close, current flow from the +4V supply through the voltage divider network formed by resistors 141 and 144 is initiated. This causes the junction 129 of the resistors 141 and 144 to swing towards the -12V supply in value, turning on the motor drive transistor 148 by forward biasing its emitter-base junction. When this happens, current flows through the blocking diode 150 and turns on motor 106.

Energization of motor 106 causes the eccentrically mounted cam 110 to rotate in slot 112. When cam 120 contacts normally closed switch 114, that switch is opened, returning junction 129 to its quiescent value which reverse biases drive transistor 148. With drive transistor 148 now cut off, current flow to motor 106 ceases and the motor 106 is turned off. Thus, for a "slow" range sensitivity web 12, the switch plate 104 is rotated, and with it the diaphragm opening 68 is enlarged, thereby compensating for the slower photosensitivity of the web 12 to be used.

In a similar manner, insertion of a cartridge 34 carrying a web 12 which has a photosensitivity response falling into the "fast" range into the web replacement station 32, causes transistors 138 and 140 to be biased on. This results in current flow through relay K1, closing

ing relay contacts K1-1 and K1-2. The closing of relay contacts K1-1 turns on drive transistor 148, which initiates drive by motor 106, until cam 122 contacts the normally closed switch 116. When this occurs, motor drive ceases with the diaphragm opening 68 having been reduced by an amount sufficient to compensate for the quicker photosensitive response of the web 12 to be used.

Finally, when a cartridge 34 carrying a web 12 which exhibits a photosensitivity response falling into the "normal" range is inserted into the web replacement station 32, both photosensors 98 and 100 are illuminated. This causes transistors 126, 130, 138 and 140 to be turned on, drawing current through both relay K1 and relay K2. The resultant closing of relay contacts K1-1 and K2-2 turns on drive transistor 148. Motor 106 is thereby energized and continues drive until the normally open switch 118 is contacted and closed by cam 124. When switch 118 is closed, and since relay contacts K1-2 and K2-2 are now both closed, current flow from the +12V supply through resistor 146 is initiated. When this occurs, because of the predetermined selection of the relative values of resistors 141 and 146, junction 129 is made sufficiently positive with respect to the base of drive transistor 148 to turn that transistor off. When drive transistor 148 is thusly cut off, motor 106 ceases to drive the switch plate 104 which has been rotated an amount sufficient to bring diaphragm opening 68 to a size which correctly corresponds to a "normal" sensitivity web 12.

It should be noted that if a "slow" web 12 replaces another "slow" one, or a "fast" web replaces another "fast" web, or if a "normal" web replaces a web of like sensitivity, motor 106 will not be energized since cam 120 will have opened and kept open switch 114, or cam 122 will have opened and kept open switch 116, or cam 124 will have closed and kept closed switch 118, respectively.

Finally, with respect to FIG. 7, it should be noted that transistor 152 serves to dynamically brake motor 106 by providing a discharge path for its back e.m.f. In a similar manner, diodes 132 and 142 provide discharge paths for the reverse currents generated by the collapsing fields of relays K1 and K2 which result when transistors 130 and 140 are turned off.

As noted with respect to the document exposure control 50, compensation in an electrostatographic copying device 10 of the type shown and described herein can be achieved in a number of ways. In a similar manner, the signals derived from code sensor 86 can be utilized to automatically adjust or modify the effect of any one of the work stations upon the utilized web 12. Thus, for example, the signals indicative of the sensitivity response of the utilized web can be employed to effect exposure compensation in a manner other than that set forth above (i.e. — shutter or filament voltage control). Alternatively, such signals can be used to vary the charge applied to the web at charging station 14 or to vary development at development station 20.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

I claim:

1. In an electrostatographic copying device which utilizes a replaceable member having a particular sensitivity response with respect to operations to be performed thereon in the device at the work stations thereof, the member carrying coded indicia of its sensitivity response, apparatus for automatically effecting compensation in the device solely as a function of the sensitivity response of the utilized member, said apparatus comprising:

- a. means for detecting the particular sensitivity response range of the utilized member and for generating a signal representative thereof;
- b. control means responsive to said signal, cooperably associated with at least one of the work stations, for achieving compensation of an associated work station's effect on the utilized member solely in accordance with the sensitivity response thereof as represented by said signal; and
- c. means for achieving original-to-original document contrast compensation cooperably associated with any one of the associated work stations, said control means including means for allowing said means for achieving and said control means to function independently of each other.

2. The apparatus according to claim 1 wherein said means for achieving and said control means are both cooperably associated for independent compensation with the same work station.

3. The apparatus according to claim 2 wherein the device includes an exposure control work station and said means for achieving and said control means are both cooperably associated for independent compensation therewith.

4. In an electrostatographic device of the type having a plurality of work stations including an exposure control station located along an endless operative path and which is adapted to utilize on the path electrophotosensitive members having a particular sensitivity response with respect to the operations to be performed thereon in the device, the members carrying coded indicia of its sensitivity response, apparatus for automatically effecting exposure compensation in the device solely as a function of the sensitivity response of a utilized member, said apparatus comprising:

- a. means for changing the exposure of the utilized member at the exposure station;
- b. sensing means for detecting and decoding the indicia of sensitivity response associated with the utilized member and for generating a signal representative thereof; and
- c. control means, cooperably associated with said means for changing and said sensing means, for automatically effecting a compensatory change in exposure of the utilized member solely in accordance with the nature of said signal generated by said sensing means, said means for changing including:
 - i. a rotatably mounted exposure diaphragm, and
 - ii. reversible drive means connected to said diaphragm and said control circuit means.

5. The apparatus according to claim 4 wherein said means for automatically effecting includes:

- a. a plurality of switching means, one each of said switching means being provided for each of the sensitivity response ranges expected into which the sensitivity response of a utilized member might

fall, cooperably associated with said means for changing, for generating a signal when said means for changing has effected an exposure change in accordance with the particular sensitivity response range of the utilized web; and

- b. control circuit means connected to said means for changing said sensing means and said plurality of switching means for controlling said means for changing to effect an exposure change in accordance with the sensitivity range of the utilized member as represented by the signals generated by said sensing means and for de-energizing said drive means in response to the signals generated by said switching means.

6. The apparatus according to claim 5 wherein said means for changing includes:

- a. a rotatably mounted exposure diaphragm; and
- b. reversible drive means connected to said diaphragm and said control circuit means.

7. The apparatus according to claim 4 wherein said device additionally includes means for achieving original-to-original document contrast compensation cooperably associated with the exposure station, said means for changing including means for allowing said means for achieving and said means for changing to function independently of each other.

8. The apparatus according to claim 7 wherein said means for changing includes:

- a. a rotatably mounted exposure diaphragm; and
- b. reversible drive means connected to said diaphragm and said control circuit means.

9. In an electrostatographic device which utilizes a replaceable web having a particular sensitivity response and carrying coded indicia of one of the possible sensitivity ranges into which the particular sensitivity of the utilized web falls, and wherein the web is disposed in the device about an endless path to be driven therealong past a plurality of work stations including an exposure station, apparatus for automatically effecting exposure compensation as a function of the sensitivity range of the utilized web, said apparatus comprising:

- a. drivable means for changing the exposure of the utilized web at the exposure station;
- b. drive means for driving said means for changing to effect exposure change;
- c. sensing means for decoding the indicia indicating the sensitivity range of the utilized web and for generating signals representative thereof;
- d. a plurality of switching means, one each of said switching means being provided for each of the sensitivity ranges expected into which the sensitivity response of the utilized web might fall, cooperably associated with said means for changing, for generating a signal when said means for changing has effected an exposure change in accordance with the sensitivity range of the utilized web; and
- e. control circuit means connected to said drive means, said sensing means and said switching means for energizing said drive means to effect an exposure change in accordance with the sensitivity range of the utilized web as represented by the signals generated by said sensing means and for de-energizing said drive means in response to the signals generated by said switching means.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,732,003 Dated May 8, 1973

Inventor(s) Conrad Altmann

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In claim 9, line 3, delete "the possible" and add
--a plurality of--.

Signed and sealed this 27th day of November 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

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